PLUG POWER OVERVIEW – DOE ROADSHOW, LONG ISLAND

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Clean, reliable, on-site energy generation

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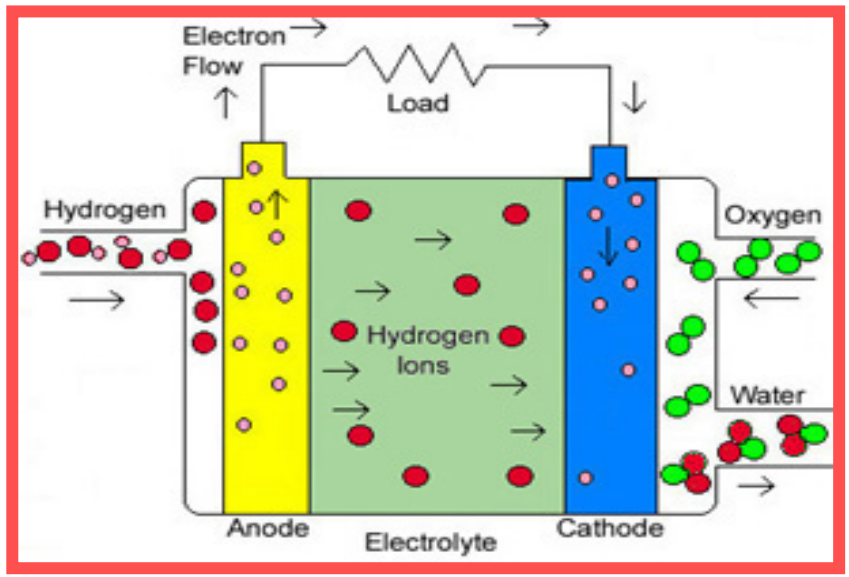
Fuel Cell - Fundamentals

$$H_2 + O_2 \rightarrow H_2O$$

A fuel cell is a device that generates electricity by electrochemically reacting hydrogen and air.



<u>Every fuel cell has</u>

One positive electrode - cathode

One negative electrode - anode

An electrolyte - carries charged particles

A catalyst - speeds up the reactions to generate electricity

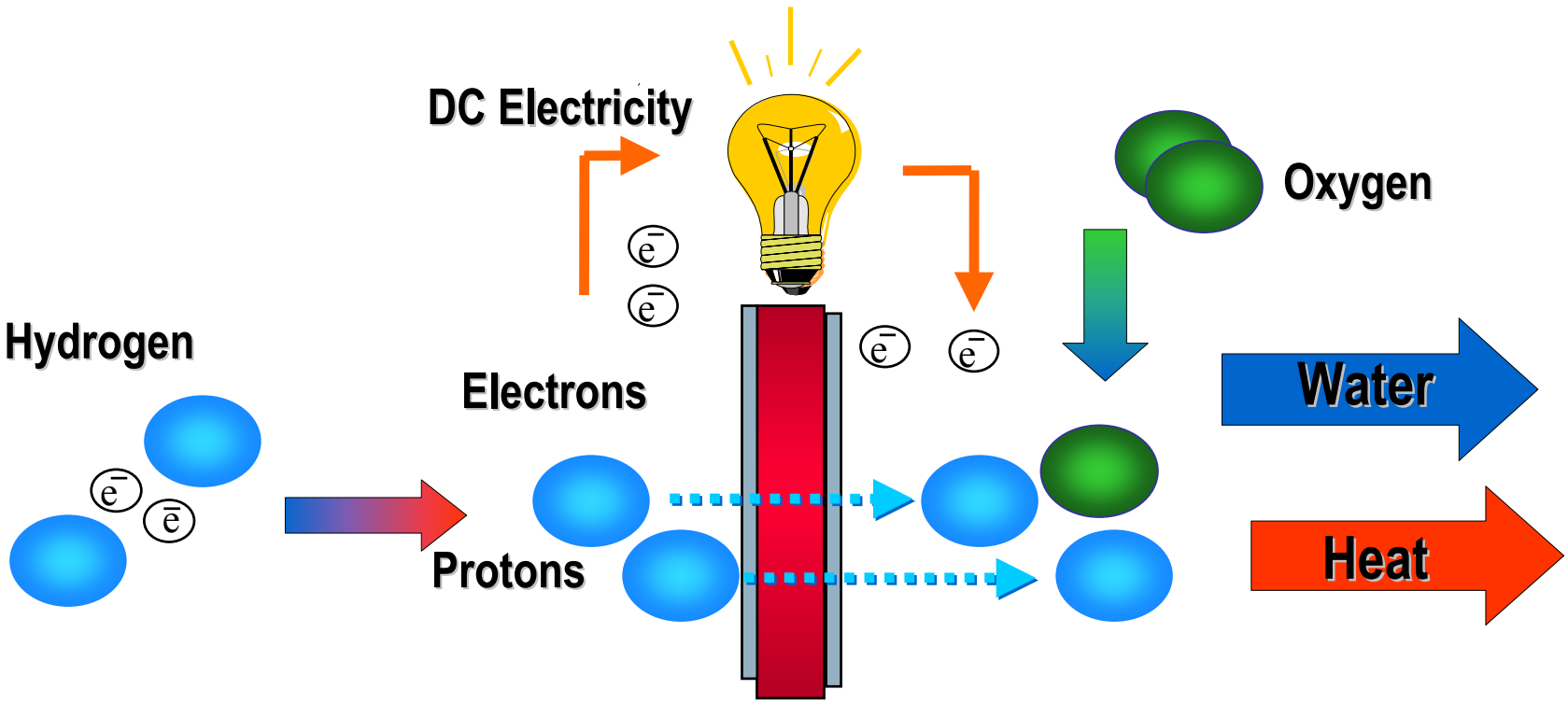
Fuel Cell Operating Comparisons

Fuel Cell Type	Electrolyte	Ions	Temperature (°C)	Cell Voltage (V)	Size (largest) (kW)
Alkaline	Potassium Hydroxide	OH-	80	0.6 - 0.8	100
PAFC	Phosphoric Acid	H+	200	0.6 - 0.8	670
MCFC	Molten Carbonate	CO_3=	550 - 650	0.7 - 0.85	250
SOFC	Solid Doped Zn-Oxide	O=	850 - 1000	0.6 - 0.75	100
PEMFC	Solid Polymer	H+	100	0.6 - 0.8	250

Fuel Cell Operating Comparisons

Fuel Cell Type	Current Density (mA/cm^2)	System Efficiency	Fuel Proc. Complexity	Stack Power Density	Transient Capability
Alkaline	60 - 120	35 - 50	Medium	Medium	High
PAFC	100 - 400	35 - 45	Medium	Medium	Medium
MCFC	100 - 200	45 - 55	Low	Low	Low
SOFC	100 - 300	45 - 50	Low	Medium	Low
PEMFC	400 - 900	32 - 40	High	High	High

Fuel Cell Process



$H_2 \Leftrightarrow 2H^+ + 2e^-$

0 Volts

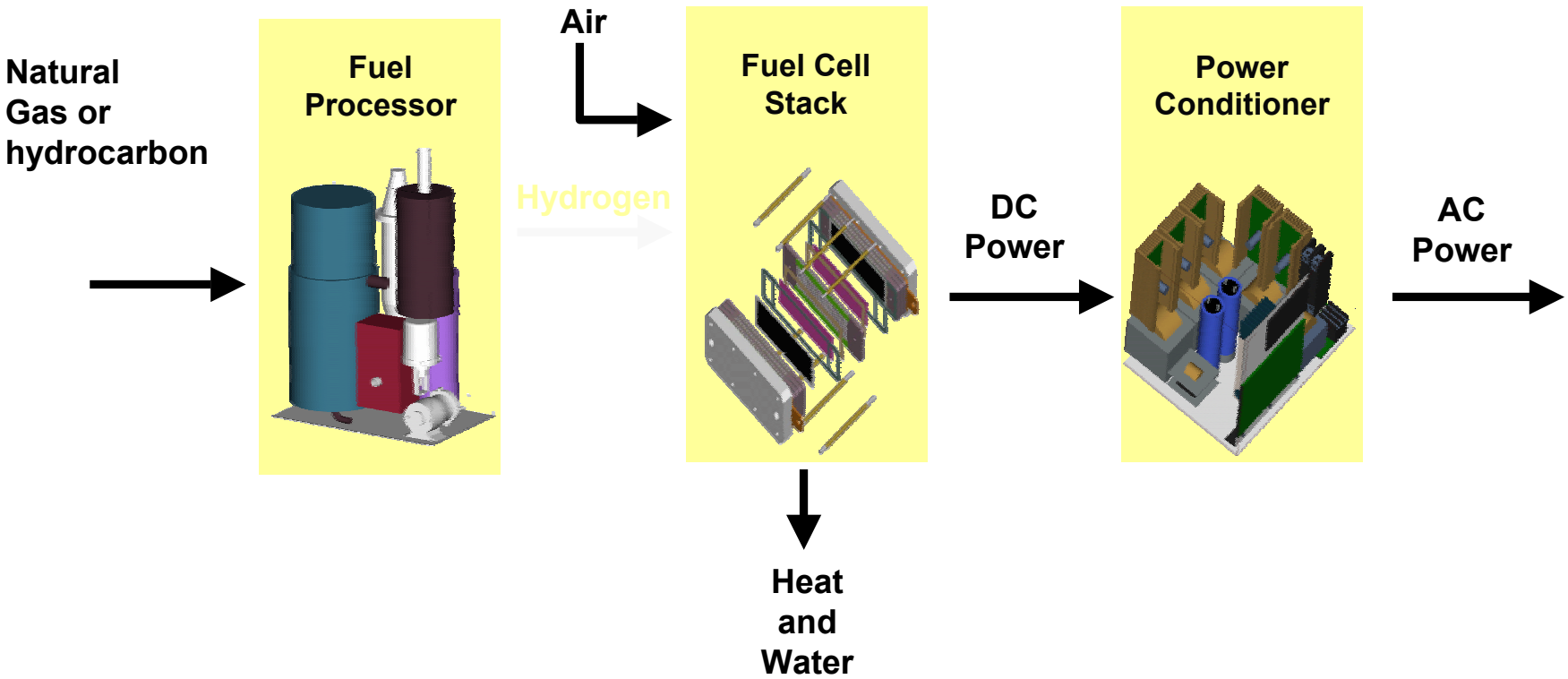
$1/2O_2 + 2e^- \Leftrightarrow 1/2O_2^{--}$

~1.23 Volts

$H_2 + 1/2O_2 \dashrightarrow H_2O$

Approx. 1 volt or less/cell, therefore add cells together

System Components



Integrated System

Fuel

Air

Water

AC Power

Heat

Fuel Processor

Power Generation

Inverter

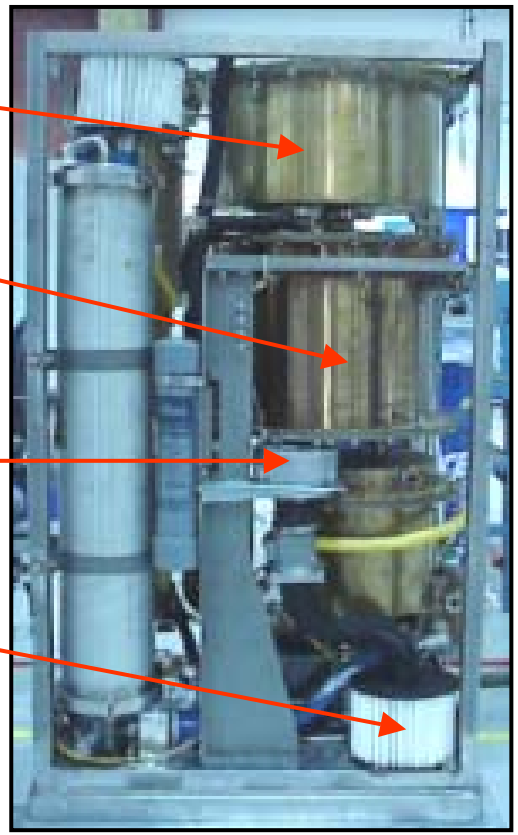
Fuel Processor

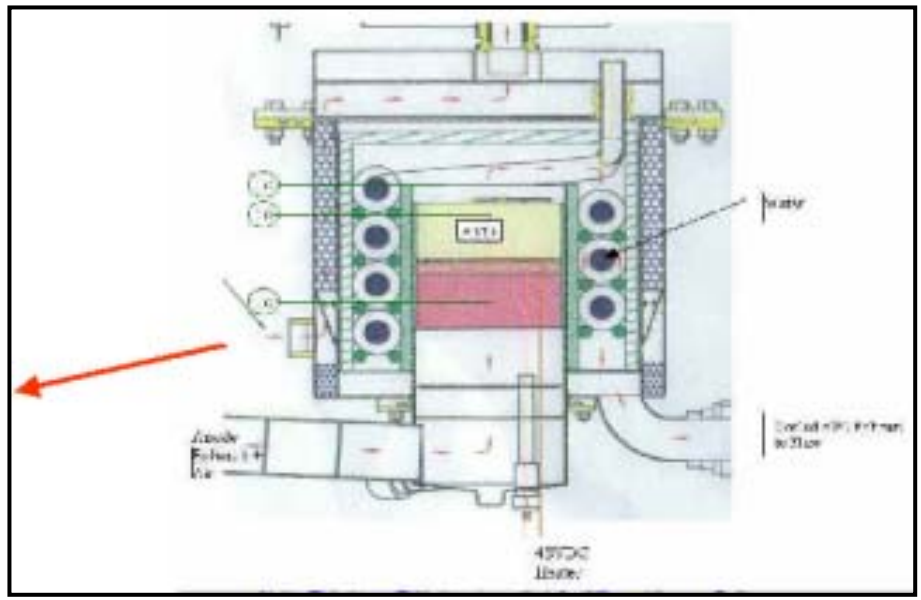
Prox

Main Reactor

ATO Blower

ATO Filter

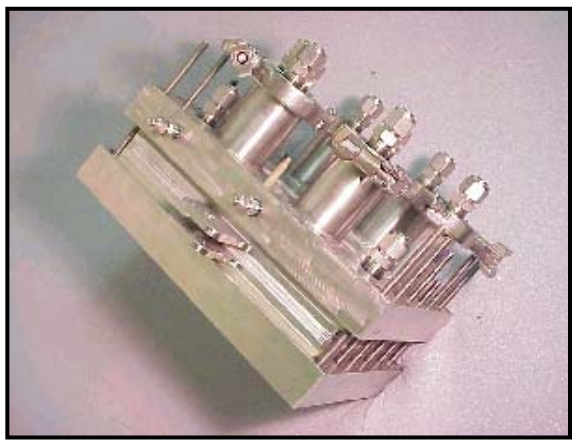




Viewed with Fuel Processing Module Side Panel Removed

Power Generation

Power Generation Module - uses hydrogen in **reformate** to produce electricity (DC voltage)



Power Generation & Balance of Plant

- Fuel & Air Delivery
- Cooling
- Waste Heat Capture
- Integrated Controls
  - Fuel Processor
  - Stack/Balance of Plant
  - Inverter/Grid

Inverter

- Convert Stack DC power or Battery DC power to AC power
- Provide Auxiliary power
-
- Provide isolation between the stack and the AC connection
- Provide control system all electrical statistics including stack voltage and current
- Provide Anti-Islanding capability

STRATEGIC INTENT

Plug Power's strategy is to be a leading provider of clean, reliable on-site energy.
We will profitably develop, market, manufacture, sell and support systems for energy consumers worldwide who value reliability and energy security.

KEY STRATEGIC RELATIONSHIPS

DTE Energy Technologies

- DTE has exclusive distribution rights for Plug Power's PEM fuel cells in Illinois, Indiana, Ohio and Michigan
- Dedicated staff of marketing and engineering specialists
- Establishing portfolio of distributed generation products
- DTE Energy owns 23.5% of Plug Power

Vaillant

- Leading manufacturer of domestic heating equipment for Europe
- 15 production sites in 7 European countries
- Key distributor / co-developer of combined heat and power products
- Distribution, installation and service network
- Operating 15 systems in 5 European countries

GE Fuel Cell Systems

- Joint venture formed in 1999
- GE is exclusive global* distributor of Plug Power's PEM fuel cell products
- Leveraging GE Power Systems' worldwide resources to establish key distribution partners
- GE owns 60% of GEFCS; Plug Power owns 40%
- GE Power Systems owns 9.4% of Plug Power

HONDA

- Joint Development Agreement for Home Refueling System (HRS) signed in Oct. '02
- HRS provides heat and electricity to the home, and hydrogen fuel to a fuel-cell vehicle
- Long-term product tied to fuel cell vehicles

LIPA

Long Island Power Authority

- Recently announced it will purchase an additional 44 fuel cell systems for installation across Long Island this year, for the first time installing them in Long Island homes

**Except Illinois, Indiana, Michigan, and Ohio*

INTELLECTUAL PROPERTY

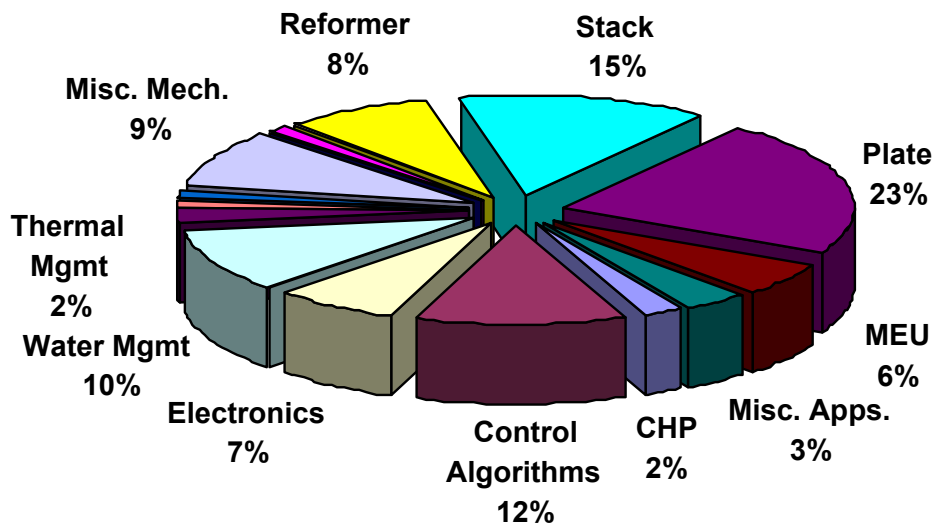
❖ CHP

Combined heat & power patent issued to provide electrical power, domestic hot water and heat to a building. Patent issued relating to the control of a fuel cell powered heating system.

❖ Anti-Islanding

Patent relating to a method of preventing power from going onto grid when grid is non-functional

Plug Power's Issued U.S. Patents by Subject Matter



93 Patents Issued, 154 Pending

On-going focus will be on systems architecture and software

MANUFACTURING

50,000 square foot production facility with approx.. 100 personnel

Organized around lean facility principles:

- Flexible by design
- Single piece flow layout
- Automated test facility

Lead-time to installation is generally less than 10 weeks

FIELD EXPERIENCE

Since January 2001:

Delivered **285** fuel cell systems to **37** different customers
in **19** U.S. states and **9** countries.
Produced more than **2.0M** kWh of electricity
in over **800,000** operating hours.



Our experience has enabled us to:

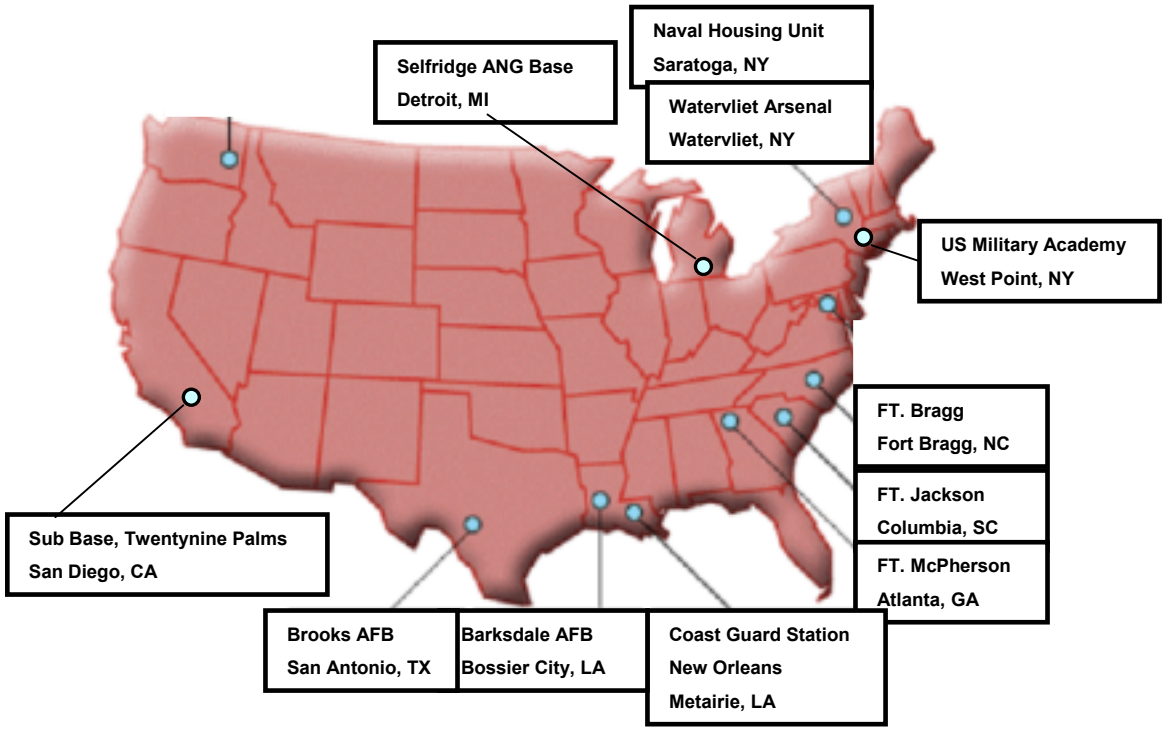
- Improve system operating characteristics
- Understand interconnection issues
- Collaborate effectively with multiple utilities
- Identify strategic intellectual property
- Operate systems in a variety of environmental conditions

CUSTOMERS - Long Island Power Authority

- Finalized a contract for approximately $3 million with the Long Island Power Authority, our largest customer, for the sale of **45** (5kW) fuel cell systems, for installation throughout Long Island this year.
- 1st time systems will be installed at residences on Long Island.

LIPA
Long Island Power Authority

CUSTOMERS – US Department of Defense



- 40 Systems delivered under US Army and US Navy programs through 2003.
- Successfully completed 10 unit program in 2003 at Watervliet Arsenal, NY.
- Broad scale operational validation using third-party service providers.

CUSTOMERS - Europe

- Vaillant GmbH and Plug Power continue to engage the European market with the installation of 13 fuel cell heating appliances in multi-family homes and small businesses in Germany, the Netherlands, Austria and Luxembourg.

- The systems were deployed as Phase 1 of the European Union's Virtual Power Plant program and to strategic customers.

Vaillant

GOVERNMENT SUPPORT FOR DG IS INCREASING

- Seeking to shape federal energy legislation in the 108th Congress
  - Tax credits of $1,000/kW for stationary fuel cells
  - Uniform interconnection standards and net metering requirements
  - Federal fuel cell purchase requirement
  - Promote development and deployment of fuel cells
- $9M in demonstration funding and $7M in buydown funding for PEM fuel cells from the Department of Defense in 2003. Seeking to increase funding in 2004
- President Bush's increased attention & funding for a hydrogen infrastructure
- Research & development funding from NIST/ATP, Department of Commerce, Department of Defense and Department of Energy

Federal government initiatives

NEW YORK STATE INCENTIVE PROGRAMS

- Efficiency Programs – Fuel Cells require external support to get to market.
- 2003 NYS Residential Tax Credit - $1500/KW up to $10K
- Executive Order 111 – 10% Renewable @ State Facilities
- Renewable Portfolio Standard – Pending with NYPSC
- PG/DG/CHP Demonstration Projects [PON 750]
  - New Baltimore DOT Rest Area – 1 LPG/CHP Fuel Cell
  - Lewiston Residential Project – 1 NG/CHP Fuel Cell
  - DASNY Headquarters – 3 NG/CHP Fuel Cells
  - AGWAY Service Center – 1 LPG CHP Fuel Cell

DOE 2003 FUEL CELLS AND HYDROGEN SOLICITATIONS

- **Stationary Fuel Cells**
  - $70M over 5 years. Closed March 27th. Plug Power has proposed on 5 topics (either as prime or sub). Development and demonstration of stationary fuel cells.
- **Hydrogen and Fuel Cells Demonstration and Validation**
  - $250M over 5 years. Expected on or about April 15th. 3-5 awards projected. Auto company/energy company lead. Stationary, Transportation fuel cells and H2 infrastructure.
- **Hydrogen Storage**
  - $30M/year for 5 years. Expected end of May. Universities and national labs as prime. Companies as subcontractors. More fundamentals /materials, some small amount of applied basic sciences and DOE EERE
- **Hydrogen Production**
  - $100M over 5 years. Expected in May. On-site H2 generation.

GOVERNMENT PARTNERS

Department of Defense

National Institute of Standards & Technology

Long Island Power Authority

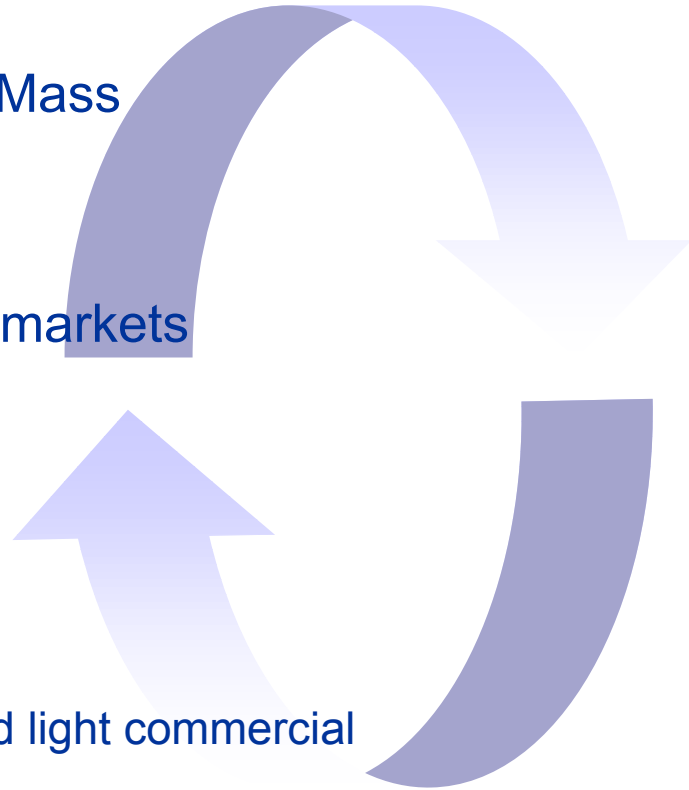
New York State Energy Research & Development Authority

Department of Energy

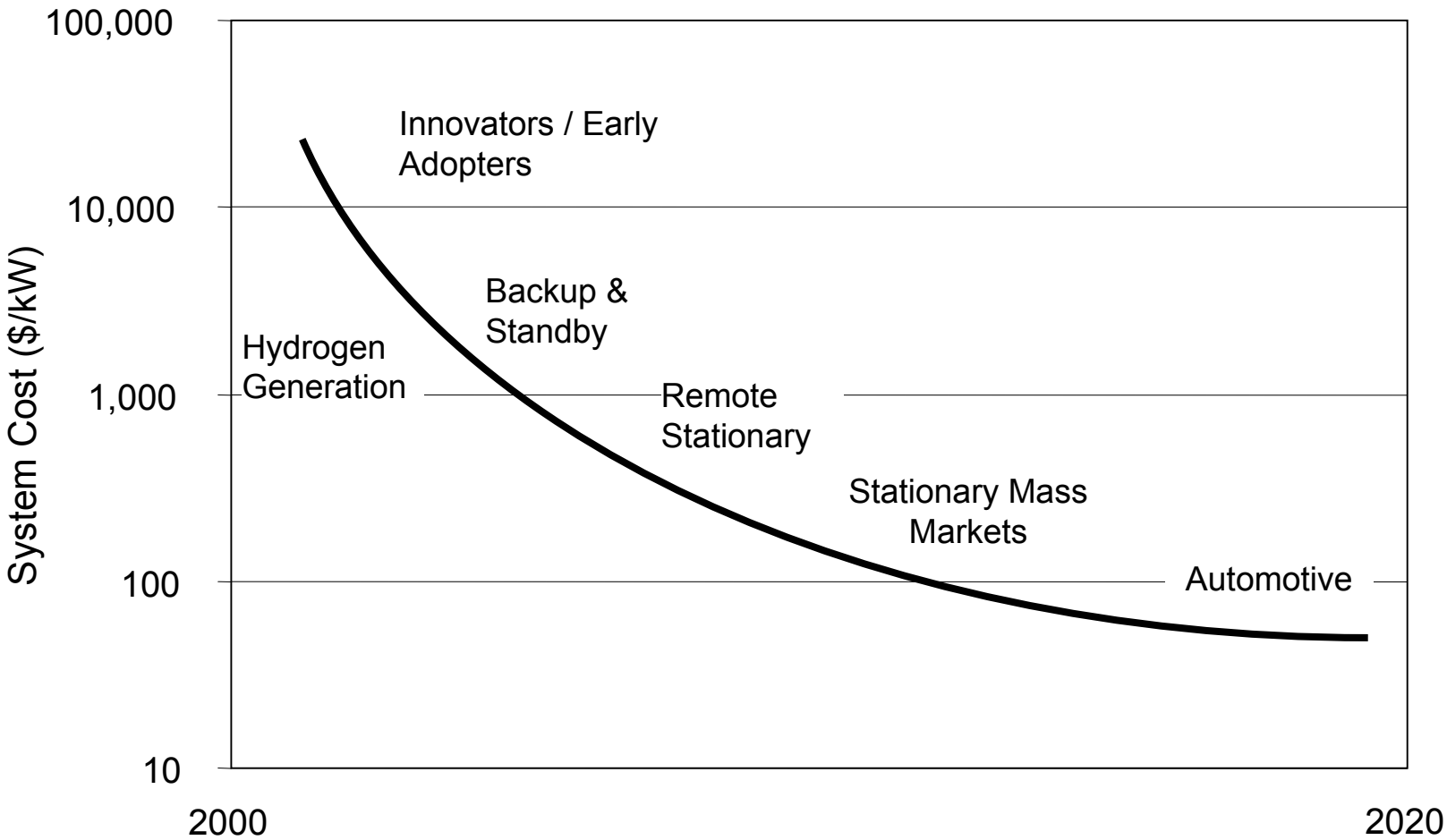
NYS Department of Environmental Conservation

PROGRESSIVE MARKET ENGAGEMENT STRATEGY

- Attractive market opportunities - Niche and Mass
- Government support increasing
- Selling products now
- Pursuing opportunities to enter commercial markets
  - BACK-UP
    - Telecom
    - Broadband
    - Uninteruptible Power Systems
  - RESIDENTIAL AND SMALL COMMERCIAL
    - Mass markets - Grid parallel residential and light commercial
  - Niche markets – Remote residential



MARKET ADOPTION



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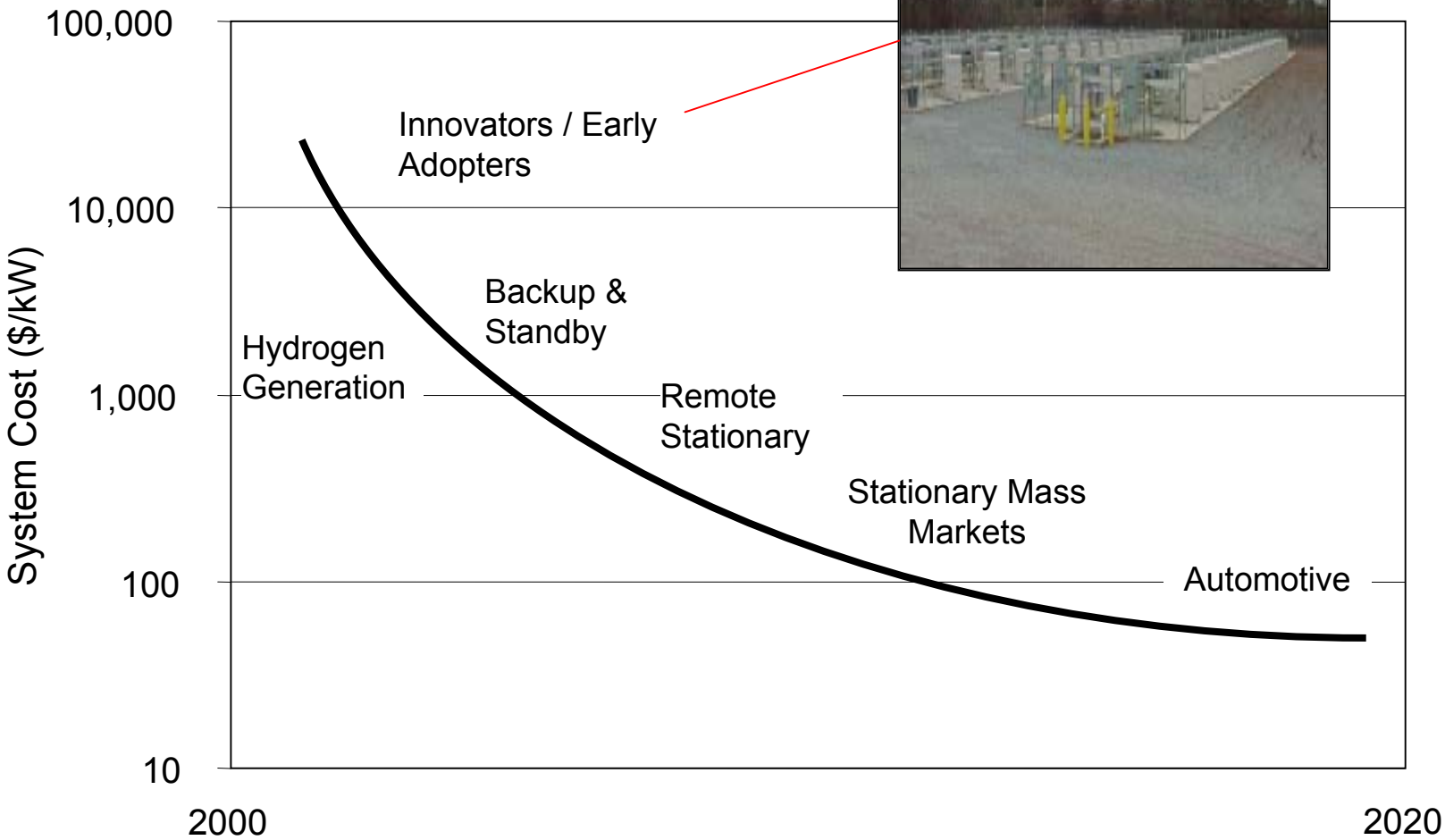
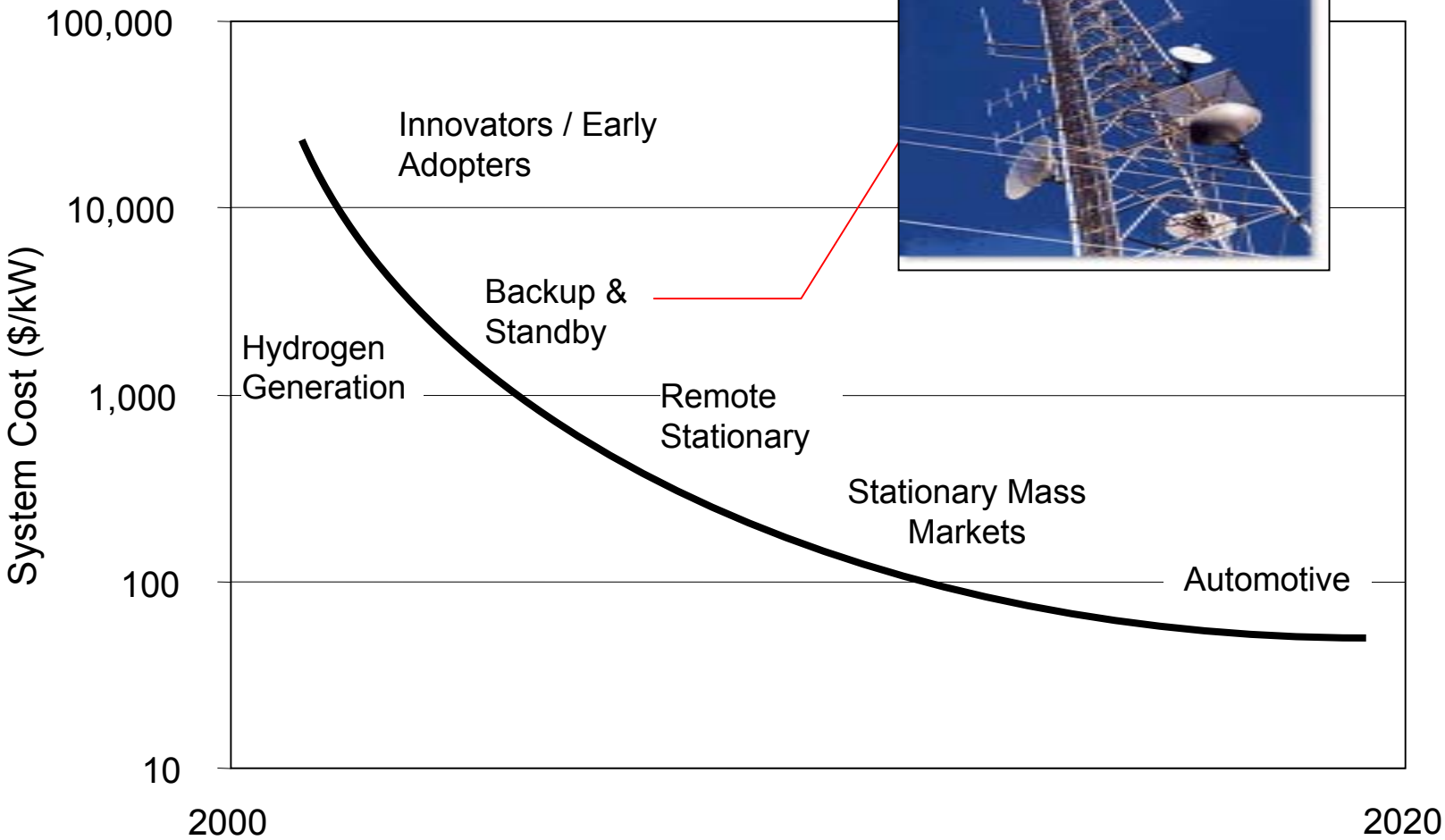


GENSYS™ PRODUCT OFFERINGS

Combined Heat and Power Fuel Cell Systems

MARKET ADOPTION



GenCore™

GenCore 5T

Value Proposition

- Low Cost of Ownership
  - Low Maintenance
- Reliable
  - Predictable runtime / performance
- Clean & Quiet
  - Zero emissions
  - No lead recycling

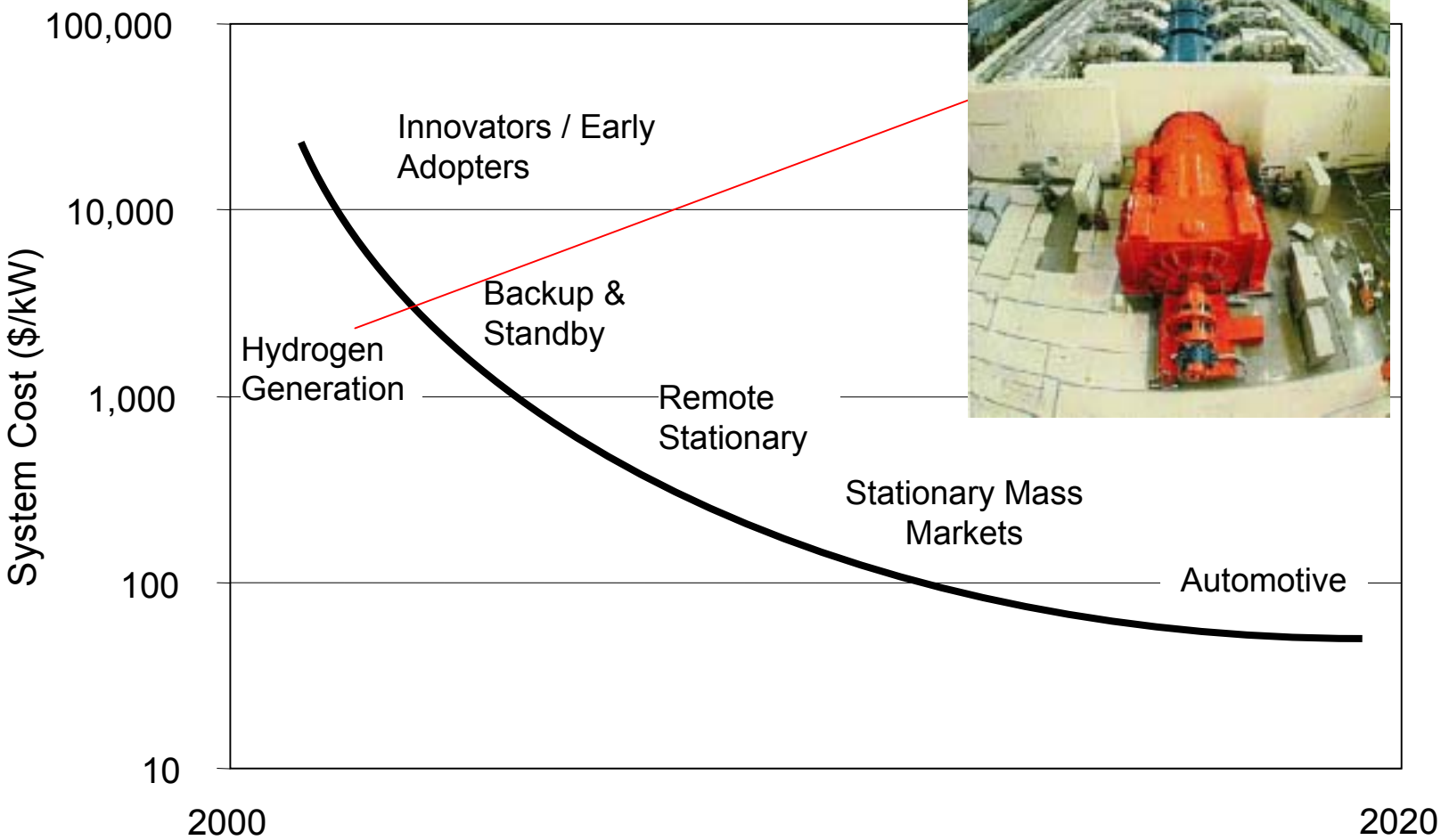
Applications

- Telecommunication back-up power
- Industrial uninterruptible power
- Substation back-up power

H_2 fueled DC back-up power supply

Valve Regulated Lead Acid Battery Replacement

MARKET ADOPTION



GenSys™

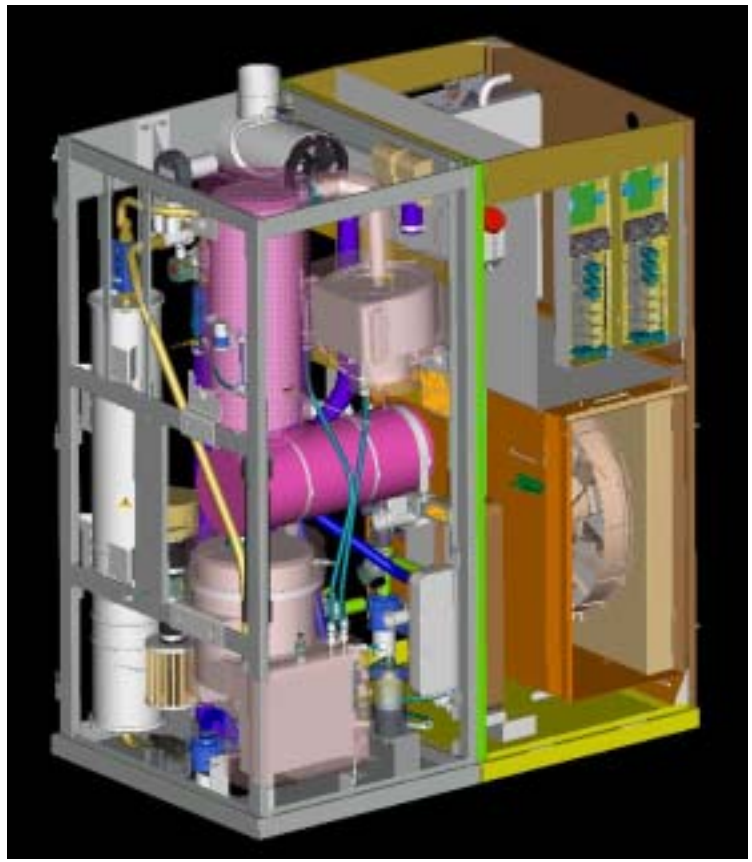
On-Site Hydrogen Generation

Value Proposition

- Economics
  - Low Cost of Ownership
    - Low Maintenance
    - Low Operating overhead
- Reliable
- Ease of Use
- Security

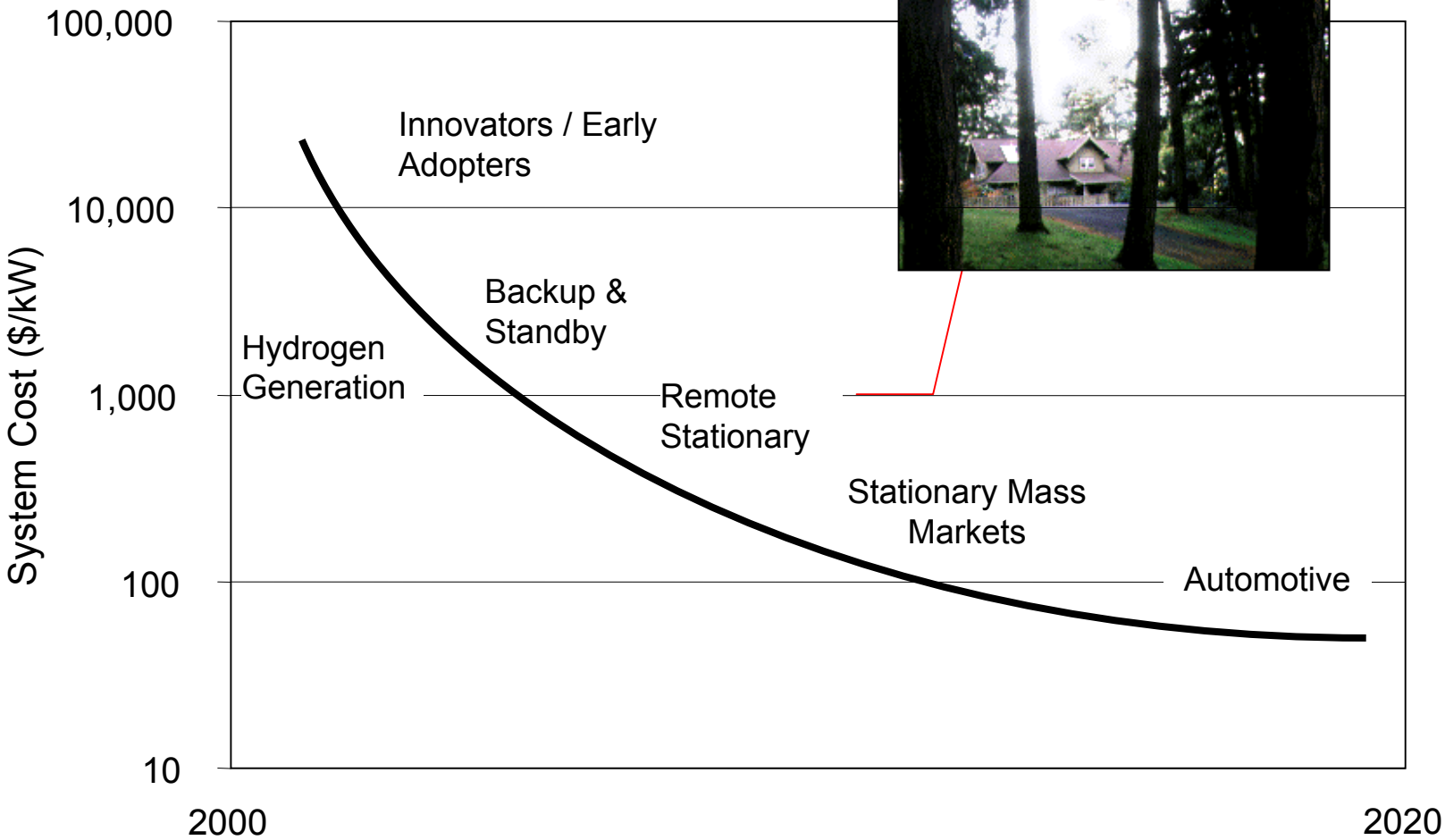
Applications

- Generator cooling at electric utility plants
- NO_x reductions on large reciprocating engine/gen sets



Economical Small Scale Hydrogen Production

MARKET ADOPTION



GenSys™

GenSys 5P

Value Proposition

- Reliable
- Environmentally Friendly
  - Quiet / Low Emissions
- Efficient
  - Lower fuel consumption
- Ease of Use
  - Power on Demand

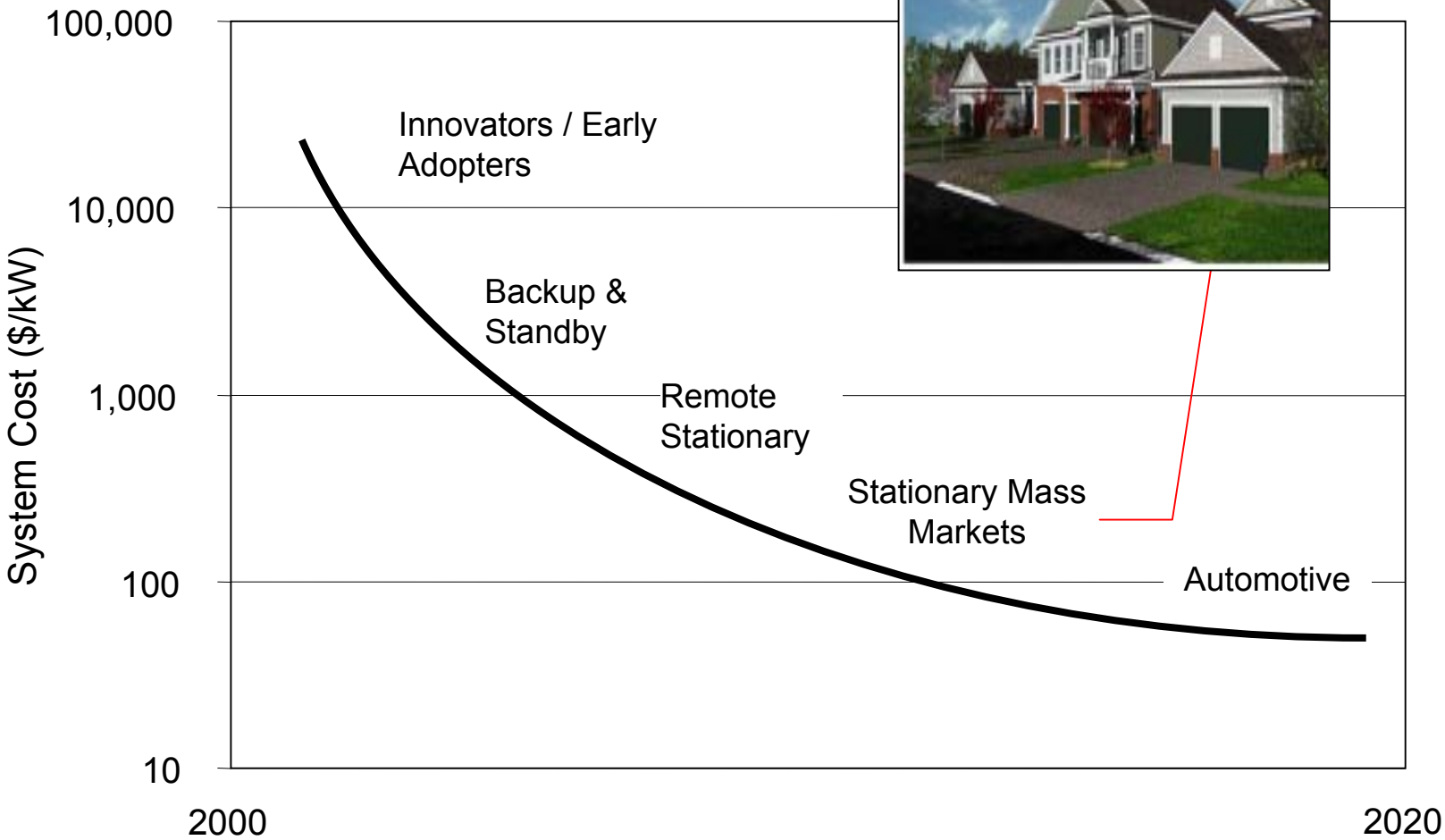
Applications

- Prime power for remote facilities: State parks, rest areas, agricultural and farming applications…

LPG fueled 120V/60Hz prime power supply

Grid Independent Remote Prime Power

MARKET ADOPTION

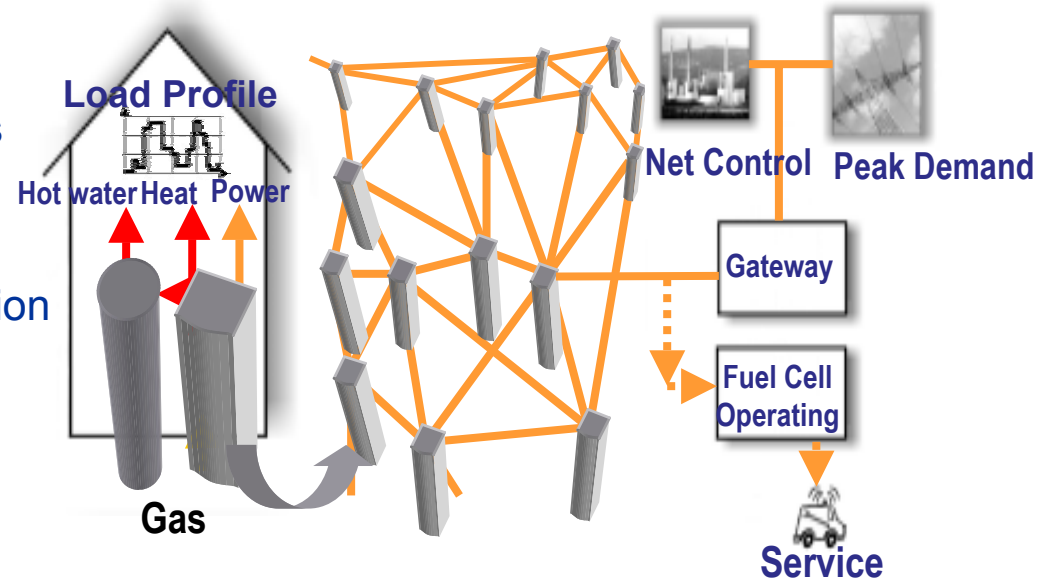


GenSys™

GenSys 5C

Value Proposition

- Environmentally Friendly
  - Efficient, Quiet & Low Emissions
- Ease of Use
  - Power on Demand
  - Install, Maintenance and Operation
- Reliability
  - Improve grid reliability
    - Black start and stand-by



Applications

- Residential / small commercial facilities in congested and load pocket areas

The Virtual Power Plant

A group of grid connected decentralized fuel cell systems that are centrally controlled to meet the peaking demand of the electric grid.

Grid Parallel Prime Power

MARKET ADOPTION

System Cost ($/kW)

100,000

10,000

1,000

100

10

2000

2020

Innovators / Early Adopters

Backup & Standby

Hydrogen Generation

Remote Stationary

Stationary Mass Markets

Automotive

PLUG POWER. PLUG WILL.

plug power
FUEL CELL SYSTEMS

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